

# Decentralized Bribery<sup>1</sup>

Sergey V. Popov

January 11, 2012

I study the decentralized bribery model, where each agent can play a role of a bureaucrat. Corruption might improve the welfare in a risk-averse world due to redistribution. There are multiple stable equilibria. High corruption level leads to lower productivity of the economy due to suppression of small businesses and higher inequality ex post.

Keywords: corruption, bribery, decentralization.

JEL: D73.

No man is an Iland, intire of it selfe;  
every man is a peece of the Continent.

John Donne

RUSSIAN LANGUAGE HAS TWO WORDS for two different classes of bribery: *likhoimstvo*, the bribery for doing things that an official should not be doing, and *mzdoimstvo*, the bribery for doing things that an official should be preventing<sup>2</sup>. Both are corruption, both are examples of using public office for personal gain. The example of the first kind of bribery can be taking a bribe for overlooking the hazardous working conditions on a factory. The example of the second kind of bribery can be gouging the bribe by threatening to stop the factory due to nonexistent violations. The first kind of bribery can be prosecuted ex-post, and it's clearly detrimental to the welfare of the economy. The second kind of bribery is simply a transfer, and is therefore perceived as innocuous, but this transfer has significant economic implications. I concentrate on the second kind of bribery in this study, and I will call it "transfer bribery" for brevity.

THIS PAPER proposes a model of bribery that does not require the existence of centralized government. The critical difference of corruption from any other endeavour is that it is principally impossible to cooperate in bribery on a significant scale. I find that decentralized bribery increases the expected rate of return of businesses simultaneously with excess supply of capital. Small corruption level might benefit the ex-ante utility of agents due to redistributive concerns, but big bribes might discourage agents from investing into smaller projects, lowering the mass of projects started up.

Decentralized corruption is relevant when a *lot* of decisions is made simultaneously by different people. A centralized corruption is relevant when one agent monopolizes the allocation of a resource. Most people face corruption *everywhere*: it's never the case that, for example, police is corrupt, but education is not. Moreover, a corrupt

<sup>1</sup> Popov: National Research University Higher School of Economics, Moscow, svp@hse.ru. The usual disclaimer applies.

<sup>2</sup> Prahlab Bardhan. Corruption and development: a review of issues. *Journal of Economic Literature*, 35(3):1320–1346, 1997; and Jakob Svensson. Eight questions about corruption. *The Journal of Economic Perspectives*, 19(3):19–42, 2005

policeman will eventually interact as a client with an educator, who in turn will be a client of a doctor. Most of the time, corrupt officials would rather pay less bribes themselves. Individual change in bribe-taking behavior, however, will not change the bribe amount that bribe-givers expect to give, and this critical issue is not captured by a single-bureaucrat approach. Decentralization of decisionmaking might not solve the corruption problem, one needs *competition* of inspectors to lower or remove the bribe.

There are benefits and there are losses due to bribery. Corruption destroys less lucrative projects, and frees up the resources that can be used in other more productive projects. Corruption serves as a redistributive mechanism: governmental officials are notoriously underpaid for the services they provide. Corrupt agents might extort anicyclically, functioning as a beneficial cushion against productivity shocks, possibly due to smart anti-corruption policy. But corruption destroys incentives for investment: smaller projects won't be able to feed both the investor and the bribe.

IN LITERATURE, the empirical consensus is that corruption is detrimental to welfare, and has a significant effect on growth in long term, and on investment in short term. Corrupt economies are mostly closed and heavily regulated. Corruption is enforced by lack of education, low income levels and ethnical heterogeneity, and ex-colonies are more prone to corruption<sup>3</sup>.

Theoretical literature is vast. Pioneered by the rent-seeking literature of Tullock [1967] and Krueger [1974], it includes a queue model of Lui [1985], where bribes are taken for advancing customers in queue and actually improve the allocation; a model of theft from government coffers in Alesina and Angeletos [2005]; a model of endogenous regulation of Aghion et al. [2009], which argues that societies with little social conscience invite more regulation; and many many others. The most close model to mine accompanies the empirical findings of Svensson [2003], which uses a survey from Uganda to illustrate that the amount of bribe depends upon the firms' prospects. The finding of the model is that because of bribes, investment into a less profitable sector which features more liquid assets might be preferred to more profitable sector with less investment reversibility exactly because officials require bigger bribes in the second scenario. Mauro [2004], incorporating corruption into a growth model, brings attention to multiple equilibria as a potential cause of difference in development trajectories, but he models corruption as stealing from governmental coffers.

<sup>3</sup> Paolo Mauro. Corruption and growth. *The Quarterly Journal of Economics*, 110 (3):681, 1995; Rafael La Porta, Florencio Lopez-de Silanes, Andrei Shleifer, and Robert W. Vishny. The quality of government. *Journal of Law, Economics, and Organization*, 15(1):222, 1999; and Simeon Djankov, Rafael La Porta, Florencio Lopez-de Silanes, and Andrei Shleifer. The regulation of entry. *The Quarterly Journal of Economics*, 117(1):1, 2002

THE PAPER is organized as follows. First, I introduce the general

model and define the equilibrium. In a second chapter, I look at the model’s predictions: I study the capital market outcomes, I study when corruption is serving a beneficial transfer function, and I illustrate that transfer bribery might move the economy into a bad equilibrium where small entrepreneurs do not start up their businesses. Finally, I discuss potential extensions, and conclude.

### 1 The Model

AGENTS INTERACT in a single-period game. There is a continuum measure 1 of ex-ante identical agents, whose preferences are defined over a single good, which can serve both consumption and investment purposes. There are two subsets of agents, not necessarily non-overlapping: *investors* and *inspectors*, both of positive mass; those who do not belong to either set are *outsiders*. There is a  $\gamma$  probability that one can become an investor, and  $\eta$  probability that one can become an inspector.

I postpone the discussion of potential model variations to the end of the paper.

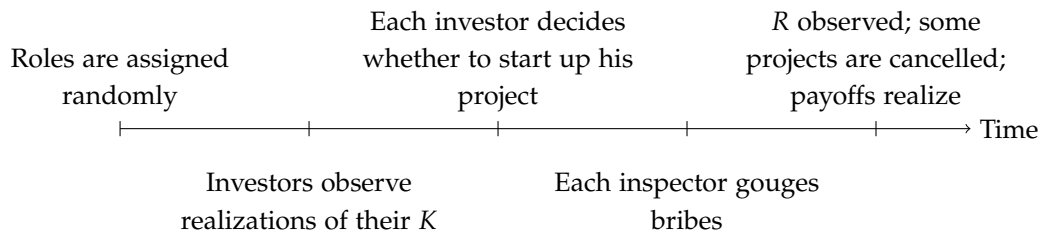


Figure 1: Timing of the game

INVESTORS are obtaining a *project* of size  $K$ : that is, it requires  $K$  units of good to invest. Projects return  $R$  per unit of investment, where  $R$  is random, idiosyncratic and not observable to investor at the time of investment. I assume that the distribution of  $R$  has pdf  $f_R(\cdot)$  and cdf  $F_R(\cdot)$ , and distribution of  $K$  has pdf  $f_K(\cdot)$  and cdf  $F_K(\cdot)$ , both distributions having full support on  $R_+$ , and  $R \perp K$ .

After investment, each investor is assigned a random inspector, who is supposed to approve the project, but instead attempts to gouge the *bribe*<sup>4</sup> from the project’s profits, a sum of money  $s$ . If the realized project’s profits after paying a bribe are negative, the project gets cancelled, and the investor loses his investment<sup>5</sup>. Since the probability of controlling the investment of your inspector is zero, the decision of an agent in the role of a inspector does not interact with the decision of the same agent in the role of an investor.

Each investor makes a decision of whether to pursue the investment project. Starting up a project of size  $K$  earns the expectation<sup>6</sup>

<sup>4</sup> Think about a story of a café owner, who after building up the café and putting up a sign gets a surprise visit from a local health department official that closes down the café for non-existent and non-verifiable terrible sanitary violations, but hints that a bribe might convince him to overlook these imaginary shortcomings. Obviously, the sum cannot be discussed openly, but the expected value is known to participants.

<sup>5</sup> 0% recovery rate here is needed for analytical ease. Formulas can be easily adapted to account for an arbitrary recovery rate.

<sup>6</sup> Here  $[\cdot]_+$  is an operator of  $\max(0, \cdot)$ .

of

$$[RK - s]_+ - K = \left( [R - \frac{s}{K}]_+ - 1 \right) K.$$

If the gross return is negative, investor cancels the project. This is an assumption that agent himself cannot be liable for the project that is not lucrative enough to pay for bribe that it faces. In other words, investor cannot be *forced* to pay the bribe, agent can choose to harvest no income from his investment. Investor has to pay the investment cost nevertheless.

The investor is starting up his project if his expected earnings are more than 0. In the case when returns follow the exponential distribution, the borderline  $s$  is governed by

$$E[R - \frac{\hat{s}}{K}]_+ = e^{-\alpha \frac{\hat{s}}{K}} \frac{1}{\alpha} \geq 1 \Rightarrow \hat{s} \leq \frac{-\ln \alpha}{\alpha} K. \quad (1)$$

Smaller  $s$  than  $\hat{s}$  makes it profitable for the investor with project of size  $K$  to start up his project.

**Result 1** *If participation constraint (1) is satisfied for some value of  $K$ , it is satisfied for the same bribe size for projects with bigger  $K$  too.*

EACH INSPECTOR observes neither  $K$  nor  $R$ , so his bribe amount is not a function of either, but he knows which projects are deemed good enough for participation by investors in equilibrium. Each inspector's problem is

$$\max_s s^\rho P(RK > s).$$

If  $\rho = 1$ , inspectors just maximize the expected amount of bribe<sup>7</sup>. Formulas further will make sense if  $\rho \in [0, 1)$ , and following results will depend upon the utility function specification. The problem of inspector is then

$$\max_s s^\rho P(R > s/K) = s^\rho \int_0^{+\infty} (1 - F_R(s/K)) f_K(K) dK. \quad (2)$$

The first-order condition is

$$\rho s^{\rho-1} \int_0^{+\infty} (1 - F_R(s/K)) f_K(K) dK = s^\rho \int_0^{+\infty} 1/K f_R(s/K) f_K(K) dK,$$

$$s^* = \rho \frac{\int_0^{+\infty} (1 - F_R(s^*/K)) f_K(K) dK}{\int_0^{+\infty} 1/K f_R(s^*/K) f_K(K) dK} = \rho \frac{P(R > s^*/K)}{E[1/K f_R(s^*/K)]}. \quad (3)$$

THE EQUILIBRIUM (pure strategy perfect Bayesian) is a collection of

- $s^* \in R_+$ : the size of bribe, amount of money taken out of the project's profits if the project happens;

Inspectors informed about  $K$  size will charge bribes as a function of  $K$ ; I postpone this issue to Section 3.

<sup>7</sup> I interpret  $\rho$  as a self-imposed restriction, caused, for example, by an implicit prosecution of stealing, which is more likely to happen to inspectors who take bigger bribes. Another interpretation is the outcome of competition among the inspectors: say, if lower-bribing inspectors attract more investors, inspectors would lower their individual bribes for a rat-race outcome of somewhat lower bribes. See Appendix A for alternative microfoundations.

When there is no uncertainty about  $K$ , Equation (3) can be rewritten as  $\frac{s^*}{K} = \rho \frac{1 - F_R(s^*/K)}{f_R(s^*/K)}$ . Assuming right-hand side to be decreasing (a technical assumption in the industrial organization literature) will guarantee the inspector's problem to have a unique solution. However, in subsection 2.3 I'll give an example of distributions of  $K$  and  $R$  that produce an increasing right-hand side of Equation (3) even though the distribution of  $R$  has a nonincreasing hazard rate.

- $K^* \in R_+$ : the level of investment such that investors with projects of size of at least  $K^*$  decide to participate;

such that

- $s^*$  is the solution to the inspector's problem (2) rationally believing that only projects above  $K^*$  are implemented, and
- an investor with a project of size  $K^*$  is weakly better off starting up the project, and all owners of projects of size less than  $K^*$  in support of distribution of projects find it suboptimal to start up the project, rationally believing in the bribe size of  $s^*$ .

If lower type projects are getting started, higher-type projects should be starting up as well. Therefore, there are three classes of outcomes, depending upon the investors' participation:

**abundance:** all sizes of projects are starting up;

**restriction:** only a subset of project sizes is starting up;

**autarky:** no projects are starting up.<sup>8</sup>

Equilibrium exists by the usual Kakutani theorem argument using the upper hemicontinuity of best responses from the Berge's theorem. There might also exist mixed strategy equilibria, but they are likely to be unstable.

<sup>8</sup> If restriction equilibrium exists, autarky equilibrium can be disregarded by the intuitive criterion of [Cho and Kreps \[1987\]](#): the bribe cannot be expected to be so big that the best possible project is not executed, because what type of projects would support these bribes?..

## 2 Model's Predictions

I study the properties of equilibria in this section. The model is compact, yet it allows me to convey the main result: the corruption can be so rampant that small businesses are not viable, and only big businesses start up. This only increases the bribe size, securing the separation between equilibria. Hence, even the transfer bribery can be harmful for the economy.

### 2.1 Tobin's Q

CAPITAL MARKETS in corrupt economies are likely to be attractive for the outside capital owners, but home investors are not reporting big profits.

Consider an outcome where all investors have the same project size equal to  $K$ . The bribe size chosen by inspectors from (2) is then

$$\frac{s}{K} = \rho \frac{1 - F_R(s/K)}{f_R(s/K)}. \quad (4)$$

Hence, the bribe is a fixed proportion of the size of capital. Assuming the decreasing hazard rate of  $f_R$  would produce a unique bribe size choice  $\bar{s}$ . Instead, I assume the existence of a positive bribe size. Then, the return of the investment project of size  $K$  is

$$E\pi(K) = E[RK - \bar{s}]_+ - K = K \left( \int_{\frac{\bar{s}}{K}}^{+\infty} \left( R - \frac{\bar{s}}{K} \right) dF_R - 1 \right).$$

**Result 2** *Conditional on starting up and not cancelling a project, the return on projects in corrupt societies are higher than in less corrupt societies.*

This is a trivial consequence of an increase in  $\rho$ : it will lower the probability of not cancelling the project, but those which were not cancelled will have a higher return on average.

What is the return rate to capital? The derivative of expected profit with respect to  $K$  from the point of view of an investor who takes the bribe size as given is

$$\frac{\partial E\pi(K)}{\partial K} = \overbrace{\left( \int_{\frac{\bar{s}}{K}}^{+\infty} \left( R - \frac{\bar{s}}{K} \right) dF_R - r \right)}^{\text{Average return}} + K \overbrace{\left( \int_{\frac{\bar{s}}{K}}^{+\infty} \left( \frac{\bar{s}}{K^2} \right) dF_R \right)}^{\text{Extra chance of no cancelling}}.$$

**Result 3** *In a corrupt economy, the marginal productivity of investment is bigger than the average productivity of investment.*

TOBIN'S MARGINAL Q is bigger than 1. The expected profit per unit of investment has to be nonnegative, or investors do not start up their projects. Since the imposed bribe is a fixed cost, even linear production function projects exhibit increasing returns to scale. This makes investors want to merge their projects. Also, aggregation of projects by some agents imposes an externality on other investors, pushing smaller investors out of starting up their smaller projects, as will be shown in 2.3.

This megalomania, however, is fruitless strategically. In the current model, the bribe constitutes a fixed proportion of the project's size. The bribe size will increase if investors merge their projects together<sup>9</sup>, resulting in no change of average productivity of a merged project. Another argument against megalomania is that it is easier for corrupt inspectors to find a bigger project to gouge a bribe from, but this is outside of the scope of current paper.

Demand for foreign direct investment should not come as a surprise about a corrupt country. Clearly, this "underinvestment" generates data indistinguishable from the excess demand for capital, and some investors will yearn to satisfy it with the capital from abroad. A response to the increased FDI will be an increase in bribe sizes.

<sup>9</sup> Here I am thinking of a hypothetical splitting of the investors set into a continuum of non-overlapping constellations of same finite size.

## 2.2 The Redistributive Benefits of Corruption

CAN CORRUPTION IMPROVE WELFARE? For the sake of this chapter, I'll assume a general density for returns and no uncertainty about the size of project. The inspector problem's (2) first order condition becomes, like in the previous chapter in (4),

$$\rho s^{\rho-1} \frac{1}{K} f_R(s/K) = s^\rho (1 - F_R(s/K)) \Rightarrow \frac{s}{K} = \rho \frac{1 - F_R(s/K)}{f_R(s/K)}.$$

Without loss of generality, normalize  $K$  to 1. Note that the choice of  $s$  does not depend on either  $\gamma$  or  $\eta$ : the decision about the bribe is made on case-by-case basis. The expected return of the project when  $\rho = 0$  (that is, there is no corruption) is  $\gamma E[R]$ . If there is corruption, the proportion of  $F(s)$  projects are getting cancelled, hence the expected ex-ante utility matches expected net return, which is

$$\gamma \left( \overbrace{(1 - F(s))E[R - s | R > s] - 1}^{\text{expected project return}} \right) + \eta \overbrace{(1 - F(s)) \frac{\gamma}{\eta} s}^{\text{expected bribe}} = \gamma \left( \int_s^{+\infty} R dF_R - 1 \right) < \gamma (E[R] - 1).$$

**Result 4** *Risk-neutral world is better off without corruption.*

LET AGENTS BE RISK-AVERSE at the point of profession assignment. Let agents be risk-neutral with respect to income after period 1.<sup>10</sup> What would ex-ante risk-averse agents choose? With corruption, ex-ante agents are lowering their exposure to  $R$  risk in case they become investors, and getting a positive payoff if they are inspectors, by giving away  $\gamma \int_0^s R dF_R$  of expected return. In case when being an investor and a inspector is mutually exclusive, and the utility of expected lifetime earnings at the point of profession assignment is  $u(\cdot)$ , the payoff is

$$\overbrace{\gamma u(p(s)E[R - s]_+ - 1)}^{\text{entrepreneur}} + \eta \overbrace{u\left(\frac{\gamma}{\eta} p(s)s\right)}^{\text{inspector}} + (1 - \gamma - \eta) \overbrace{u(w)}^{\text{outsider}}.$$

Here  $p(s) = P(RK > S)$ . One can use this problem to solve for the optimal government size as determined by the curvature of  $u(\cdot)$ . One can also see that very few choices of  $\eta$  produce a time-consistent optimal choice of  $s$  (that simultaneously maximizes the ex-ante utility of the agent and solves the inspector's problem take  $\eta$  and  $\gamma$  as given).  $\gamma$  is unlikely to be a choice variable, but an increase in  $\gamma$  would increase the expected payoff, holding everything else constant.

<sup>10</sup> We'll still model the inspector's behavior as risk-averse when they decide on the size of the bribe. See discussion in footnote 7.

I assume that both investors and inspectors give up the outsiders' payoff. This is not critical for the findings, but it is critical when discussing the effects of raising or lowering the wages of government employees for corruption deterrence. For example, the increase in  $w$  here makes the "beneficial" corruption smaller, and corresponds to an increase of the gap between the salary of inspector and outsider. Therefore, better wages at the government might actually make the redistributive role of corruption more beneficial, lowering the incentives of a benevolent government to fight bribery. This does not take into the account the effect of the wage differential on  $\rho$ .

**Result 5** *The socially optimal quantity of inspectors is equal to  $1 - \gamma$  when  $u$  is concave and  $w = 0$ .*

To see why this result is true, observe that the first-order condition can be rewritten in the form of  $u\left(\frac{\gamma}{\eta}s\right) - \frac{\gamma}{\eta}su'\left(\frac{\gamma}{\eta}s\right) - u(0)$ , which is positive for concave increasing functions, and therefore the optimum is on the boundary. Increase in  $w$  might make the optimal  $\eta$  less than  $1 - \gamma$ .

**Result 6** *Big enough  $w$  makes socially optimal  $\eta = 0$  even with ex-ante risk-aversity.*

Whether investors or inspectors are better off in terms of expected lifetime income depends upon the shape of  $F_R(\cdot)$ .

ANOTHER WAY OF THINKING about this argument is that agents do not consume the final good, but rather invest it with a production function exhibiting decreasing returns to scale. In economies with inefficient capital markets<sup>11</sup>, reallocation of a part of income of those who stumbled upon lucrative projects into the families of those who ended up on governmental jobs might increase the total output of the economy.

<sup>11</sup> A significant collateral requirement might be prohibiting for participation in capital market.

THIS ARGUMENT CLEARLY ONLY WORKS in the economies where the total amount of bribes is big, but returns are bigger, and the aversity of risk of being an outsider is compensating for the loss due to waste of cancelled projects.

### 2.3 *The Squandering Folly of Corruption*

THE ENVIRONMENT that I will use for this chapter features the heterogeneity with respect to project size and exponential returns. Let  $K \in \{K_L, K_H\}$  with probabilities  $\lambda$  and  $1 - \lambda$  correspondingly, and  $R \sim \text{Exp}(\alpha)$ , so that  $P(R > t) = e^{-\alpha t}$ . Then, if both types of projects are getting started up, the utility of the inspector as a function of the stolen amount  $s$  is

$$E[s^\rho I(RK > s)] = s^\rho P(RK > s) = s^\rho \left( \lambda e^{-\alpha \frac{s}{K_L}} + (1 - \lambda) e^{-\alpha \frac{s}{K_H}} \right). \quad (5)$$

TO SOLVE FOR EQUILIBRIUM, first consider the best response of inspectors. The first-order condition of the inspector's problem (5) is

$$\rho s^{\rho-1} \left[ \lambda e^{-\alpha \frac{s}{K_L}} + (1 - \lambda) e^{-\alpha \frac{s}{K_H}} \right] = s^\rho \alpha \left[ \frac{\lambda}{K_L} e^{-\alpha \frac{s}{K_L}} + \frac{1 - \lambda}{K_H} e^{-\alpha \frac{s}{K_H}} \right].$$



Rewrite to get

$$s = \frac{\rho \lambda e^{-\alpha \frac{s}{K_L}} + (1-\lambda) e^{-\alpha \frac{s}{K_H}}}{\alpha \frac{\lambda}{K_L} e^{-\alpha \frac{s}{K_L}} + \frac{1-\lambda}{K_H} e^{-\alpha \frac{s}{K_H}}} = \rho \frac{K_L}{\alpha} \left( 1 + \frac{\left(1 - \frac{K_L}{K_H}\right) e^{\alpha \frac{s}{K_H}}}{\frac{\lambda}{1-\lambda} + \frac{K_L}{K_H} e^{\alpha \frac{s}{K_H}}} \right). \quad (6)$$

Right-hand side is an increasing function of  $s$ , starting from a value above  $r \frac{K_L}{\alpha}$  and converging to  $r \frac{K_H}{\alpha}$ . Therefore, there is a fixed point.

When only  $K_H$  project size is started up, the inspector's first-order condition's right-hand side changes:

$$s = \frac{\rho \cdot 0 \times e^{-\alpha \frac{s}{K_L}} + 1 \times e^{-\alpha \frac{s}{K_H}}}{\alpha \frac{0}{K_L} e^{-\alpha \frac{s}{K_L}} + \frac{1}{K_H} e^{-\alpha \frac{s}{K_H}}} = \frac{r K_H}{\alpha}. \quad (7)$$

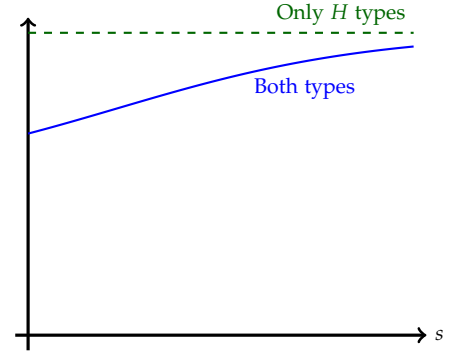
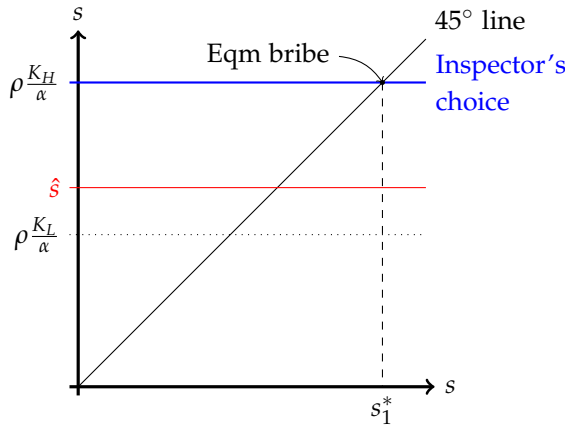
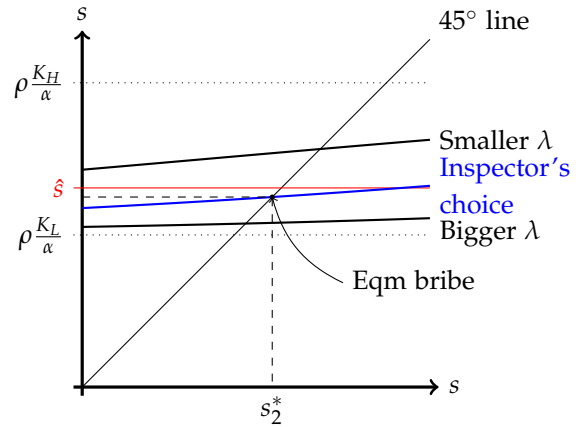


Figure 2: The right-hand side of Equation (6) (solid line) and Equation (7) (dashed line).

WHEN INSPECTORS ARE RISK-AVERSE, there might be multiple equilibria under reasonable assumptions. Figure 3 shows an example of such an outcome. Both equilibria are stable in the sense that a tiny changes in the fundamentals of both investors' and inspectors' problems do not make either equilibrium go away. It is obvious from the Figure 3 that the abundance equilibrium needs small  $\alpha$  and/or small enough  $\rho$  for every given  $\lambda$  to exist. Lowering  $\frac{K_H}{K_L}$  also lowers the bribe size without affecting the threshold bribe for participation constraint.



(a) Only  $K_H$  projects start up



(b) Both project types start up

NOTE:  $\alpha = 0.4$ ,  $K_L = 1$ ,  $K_H = 2$ ,  $\lambda = 0.7$ ,  $\rho = 0.7$ . Since  $K_L = 1$ ,  $\hat{s}$  is the bribe that agents with type  $L$  projects can pay and be indifferent between starting up the project or not; see Equation (1). For  $K_H$  projects,  $2\hat{s} > \rho \frac{K_H}{\alpha}$ , so restricted equilibrium exists.

Figure 3: Multiple equilibria

IN THE WORLD OF RISK-NEUTRAL INSPECTORS, or when  $\rho = 1$ , it is quite hard to obtain the existence even of the restricted equilibrium.

This, of course, is driven by the assumption of exponential distribution. Other distributions will have other shortcomings.

**Result 7** When  $\rho = 1$  and the inspector can observe  $K$ , projects are executed only if  $E(R) = \frac{1}{\alpha} > e$ .

Indeed, assume we are in the world where  $\rho = 1$  and inspectors observe  $K$  (or they expect only one type of projects to start up). They expect the bribe to be  $s = \frac{1}{\alpha}K_H$ , so that  $\frac{s}{K} = \frac{1}{\alpha}$  in the investor's problem. Investor will participate when

$$E[R - \frac{1}{\alpha}]_+ > 1 \Rightarrow e^{-\alpha \frac{1}{\alpha}} \frac{1}{\alpha} > 1 \Rightarrow \frac{1}{\alpha} > e.$$

**Result 8** When  $\rho = 1$ , no projects are executed unless  $E(R) = \frac{1}{\alpha} > e$ .

Assume only the best projects are executed. Apply Result 7 to get the result. Now assume both types of project are started up. Remember that Equation 6 that governs the optimal choice of  $s$  guarantees that  $s$  is at least  $\frac{K_L}{\alpha}$  (and in fact only takes this value if the quantity of  $L$  projects  $\lambda$  is equal to 1). By the reasoning similar to Result 7, investors with projects of size  $K_L$  will not start up their projects, and abundance outcome cannot happen here.

The assumption of  $\frac{1}{\alpha} > e$ , or that the net return to projects is more than 171% on average, strikes me as improbable. Therefore, the only reasonable outcome in the case of risk-neutral inspector is autarky, famine and desolation.

## 2.4 Multiple Inspectors

HAVING TO PASS JUST ONE INSPECTOR is a simplification. This section studies the change in equilibrium if we allow investors some freedom of choice of the inspector.

If the approval of one of two corrupt inspectors is *sufficient* for the project to continue, inspectors will either have a mixed strategy, or converge to the Bertrand outcome of zero bribe, depending on the ease with which investors can change their inspector.

If two inspectors are both *necessary* for the project to go on, this will bring more project cancellations into the economy. Since inspectors cannot conspire (and if they did, they would behave as one inspector), each inspector will have less effect on a change in probability of soliciting a bribe with his own bribe change, hence the total bribe amount will grow.

Consider a problem of one of the two inspectors in this case. Let  $s^*$  denote the bribe that is going to be charged by another inspector:

$$\max_s s^\rho P(R > s+s^*/K) \Rightarrow \frac{s}{K} = \rho \frac{1 - F_R(s+s^*/K)}{f_R(s+s^*/K)}.$$

In equilibrium,  $s = s^*$ , and therefore  $\frac{2s^*}{K} = 2\rho \frac{1-F_R(2s^*/K)}{f_R(2s^*/K)}$ . Thus, the total bribe  $2s^*$  is an intersection of a 45° degree line and a curve *above* the first-order condition curve (4). Uncertain quantity of inspectors per project is dealt with analogously. Participation constraint though will be harsher with an increase of quantity of inspectors, or even introduction of more uncertainty in the quantity of inspectors, and  $K^*$  might increase.

Caveat: intersection has to be unique when the inspector is alone.

### 3 Discussion

WHY HAVE INSPECTORS? This study did not address the question of why are there this need for an inspector: removing the inspector role seems to be welfare-improving in settings close to risk-neutrality. This study, simultaneously, did not address the kind of bribery when officials by closing their eyes on companies' opportunistic behavior cause negative externalities on the welfare of other people. I deem the existence of inspectors necessary because these inspectors are not letting "bad" investors run their harmful projects. The harmful nature of such projects obviously will make bribery devastating to welfare, but simultaneously this harmfulness is usually technically detectable, and hence prosecutable.

PRIVATE INFORMATION ABOUT RETURNS is a seemingly innocuous assumption. One could have two distributions of return, a stochastically better one and a stochastically worse one, and disregard the uncertainty about the investment size. Then subsection 2.3 results will still be applicable: projects with worse return might be socially optimal to implement, but the bribe might be too big to start up these projects.

However, if it's *inspectors* who have private information about the prospects of individual projects, the outcome somewhat changes from the baseline scenario. Indeed, if the inspector could credibly demonstrate his good signal to an investor, inspector could count on a bigger bribe. But there is no reason to report such signal truthfully when inspector cannot credibly prove that this is the true signal. Whether it is possible to harvest bigger bribes greatly depends on whether investors will believe the inspector's signals<sup>12</sup>.

THE UNINFORMED INSPECTORS ASSUMPTION regarding the investment size makes the result of small businesses suppression stronger. Let us return to the two types of project size scenario of subsection 2.3. Assume the inspector is informed: he gets a correct signal about the project's type with probability  $q > 1/2$ , and an incorrect signal

<sup>12</sup> Vincent P. Crawford and Joel Sobel. Strategic information transmission. *Econometrica*, 50(6):1431–1451, 1982. ISSN 00129682

with probability  $1 - q$ . Then, conditional on a signal that the type of the project is higher, the bribe that the inspector is going to expect is higher. This will make the average bribe for  $K_L$  projects lower, making it more likely that investors with small projects can participate in the market. Instead of squandering  $\lambda$  of  $K_L$  projects, informed inspectors might lower these losses to  $(1 - q)\lambda$ . This will make them forego some bribe amount on bigger projects, and it is not immediately clear whether having “smarter” (in terms of  $q$ ) inspectors necessarily improves the total collected bribe amount.

HONEST INSPECTORS that do not ask for bribes will relax the participation constraint, creating a more hospitable atmosphere for small businesses, but simultaneously they will let big fish go away non-squeezed. The body of corrupt officials might actually be interested in cleansing the ranks, depending upon the shape of  $f_R$  and the size of  $\alpha$ , albeit just to the point of abundance equilibrium existence, not necessarily to the socially optimal corruption.

#### 4 Conclusion

In this study, I find that the transfer bribery is not economically neutral. Not only it destroys some of the output of less productive projects, it can shrink the set of projects that are started up. Too high bribe size might not only kill the *less lucrative* projects, but also can discourage *small* businesses from opening up, since bureaucrats cannot distinguish the investment size from the investment’s return. Another consequence of the transfer bribe being essentially a fixed cost is that projects in corrupt economies are exhibiting the features of increasing returns to scale, and higher productivity than in non-corrupt economies.

As any transfer, bribes can be beneficial if the alternative of becoming an investor is too grim: a society with big unemployment might be eager to forego a less lucrative portion of investment projects to redistribute the benefits obtained by entrepreneurs. I do not believe this benefit is effective in long run, but it does explain why corruption is only frowned upon in developing countries. It also makes it clear why entrepreneurs become interested in social responsibility and donating a portion of incomes to poor: they would rather give up a portion of their income before the needy become an authority and get an opportunity to issue permits. One example of such self-organization might be the trade unions in US in 1950s<sup>13</sup>; another is the “patent trolling”, intellectual property protection gone amok<sup>14</sup>.

In general, I argue, there is no need to have governmental coffers or any public good provisions for corruption to be harmful to the

The inspector can convey his bribe expectations by citing the “violated” statute codes: a corrupt traffic officer could threaten a driver with KY plates with a speeding ticket, and a driver with NH plates with reckless driving.

<sup>13</sup> John Hutchinson. The anatomy of corruption in trade unions. *Industrial Relations: A Journal of Economy and Society*, 8(2):135–150, 1969

<sup>14</sup> Benjamin H. Diessel. Trolling for trolls: The pitfalls of the emerging market competition requirement for permanent injunctions in patent cases post-ebay. *Michigan Law Review*, 106:305, 2007

society. A simple case to consider is issuing foreign passports: if this endeavour is bribe-free, the question of whether to go to another country for a vacation is a question of travel ticket affordability. But if citizens expect to pay a bribe, they will only go to get a passport if they really want (or need) to go abroad, and this means they are eager to pay a little bit more. It's the competition for inspection or the ability to opt to be handled by a different official that can curb corruption. On the other hand, such an opportunity will worsen the outcome for the corruption when an official is breaking the spirit, if not the letter, of the law: an opportunity to pick an inspector will make the process of searching for corrupt ones easier.

## References

- Philippe Aghion, Yann Algan, Pierre Cahuc, and Andrei Shleifer. Regulation and distrust. Technical report, National Bureau of Economic Research, 2009.
- Alberto Alesina and George-Marios Angeletos. Corruption, inequality, and fairness. *Journal of Monetary Economics*, 52(7):1227–1244, 2005.
- Prahlab Bardhan. Corruption and development: a review of issues. *Journal of Economic Literature*, 35(3):1320–1346, 1997.
- In-Koo Cho and David M. Kreps. Signaling games and stable equilibria. *The Quarterly Journal of Economics*, 102(2):179, 1987.
- Vincent P. Crawford and Joel Sobel. Strategic information transmission. *Econometrica*, 50(6):1431–1451, 1982. ISSN 00129682.
- Benjamin H. Diessel. Trolling for trolls: The pitfalls of the emerging market competition requirement for permanent injunctions in patent cases post-eBay. *Michigan Law Review*, 106:305, 2007.
- Simeon Djankov, Rafael La Porta, Florencio Lopez-de Silanes, and Andrei Shleifer. The regulation of entry. *The Quarterly Journal of Economics*, 117(1):1, 2002.
- John Hutchinson. The anatomy of corruption in trade unions. *Industrial Relations: A Journal of Economy and Society*, 8(2):135–150, 1969.
- Anne O. Krueger. The political economy of the rent-seeking society. *The American Economic Review*, 64(3):291–303, 1974.
- Rafael La Porta, Florencio Lopez-de Silanes, Andrei Shleifer, and Robert W. Vishny. The quality of government. *Journal of Law, Economics, and Organization*, 15(1):222, 1999.
- Francis T. Lui. An equilibrium queuing model of bribery. *The Journal of Political Economy*, 93(4):760–781, 1985.
- Paolo Mauro. Corruption and growth. *The Quarterly Journal of Economics*, 110(3):681, 1995.
- Paolo Mauro. The persistence of corruption and slow economic growth. *IMF Staff Papers*, pages 1–18, 2004.
- Jakob Svensson. Who must pay bribes and how much? Evidence from a cross section of firms. *The Quarterly Journal of Economics*, 118(1):207, 2003.
- Jakob Svensson. Eight questions about corruption. *The Journal of Economic Perspectives*, 19(3):19–42, 2005.
- Gordon Tullock. The welfare costs of tariffs, monopolies, and theft. *Western Economic Journal*, 5(3):224–232, 1967.

## A How To Argue That $\rho$ Can Be Less Than 1

Consider a variation of the baseline model where bribe-gouging is risky. Let  $K$  be known. If bribe is gouged, the investor is upset, and he's going to complain to the relevant authorities with probability  $G(s/s^*)$  for behavioral reasons, where  $s$  is the bribe that investor had to pay and  $s^*$  is the average bribe in the economy. Let  $G(\cdot)$  have the features of a cdf on an interval support that includes 1, with a continuous derivative. Complaint results in the fining the inspector for the amount of bribe. Assume inspector is truly risk-neutral. This changes the inspector's problem into

$$\max_s (1 - F_R(s/K))(1 - G(s/s^*))s.$$

What restrictions are imposed on  $G(\cdot)$  by substituting this complicated interaction with a risk-averse inspector's behavior,

$$\max_s (1 - F_R(s/K))s^\rho,$$

like the formula I was using along the text of the paper, (2)? In the risk-averse proxy case, the first-order condition produces this optimality equation:  $\frac{s}{\rho} = \frac{1 - F_R(s/K)}{1/K f_R(s/K)}$ , a rewrite of (4)<sup>15</sup>. In the risk-neutral case with the risk of complaint, the first-order condition looks like that:

<sup>15</sup> Here and everywhere below I abstract away from multiple intersections of relevant functions with a 45° line.

$$-f_R(s/K)(1 - G(s/s^*))s + (1 - F_R(s/K))(1 - G(s/s^*)) - (1 - F_R(s/K))g(s/s^*)s/s^* = 0.$$

Rewrite to bring closer to the condition of the convenient way:

$$\frac{s(1 - G(s/s^*))}{1 - G(s/s^*) - g(s/s^*)s/s^*} = \frac{1 - F_R(s/K)}{1/K f_R(s/K)}.$$

Right-hand sides of conditions implied by two approaches are same. Let  $t = \frac{s}{s^*}$ ; in equilibrium,  $t = 1$ . The need for equality of left-hand sides at equilibrium requires  $g(\cdot)$  to satisfy:

$$\frac{1}{\rho} = \frac{1 - G(1)}{1 - G(1) - g(1)} \Rightarrow \frac{g(1)}{1 - G(1)} = 1 - \rho.$$

This is a necessary condition. A sufficient condition would require making  $g(\cdot)$  and  $G(\cdot)$  satisfy the following condition:

$$g(t)t = (1 - G(t))(1 - \rho) \Rightarrow G(t) = 1 - ct^{\rho-1}.$$

in the big enough neighborhood of  $t = 1$ .  $c$  here is a positive integration constant (when  $\rho < 1$ ); obviously, for every value of  $c$  the support for  $t$  is  $[c^{1/(1-\rho)}, +\infty)$ , and one needs  $c < 1$  to have  $t = 1$  inside the support.  $c$  has an interpretation of the proportion of bribes

that remain unpersecuted among the bribes that are successfully extorted.

The only thing left to verify is that taking a bribe of size  $c^{1/(1-\rho)}s^*$  (the biggest bribe that creates no chance to get caught) is less profitable than taking a bribe of size  $s^*$ :

$$\left(1 - F_R\left(c^{1/1-\rho}\frac{s^*}{K}\right)\right) \underbrace{(1 - G(c^{1/1-\rho}))}_{1} c^{1/(1-\rho)}s^* < (1 - F_R(s^*/K)) \underbrace{(1 - G(1))}_{c} s^*.$$

$$\left(1 - F_R\left(c^{1/1-\rho}\frac{s^*}{K}\right)\right) c^{1/(1-\rho)}\frac{s^*}{K} < c(1 - F_R(s^*/K))\frac{s^*}{K}.$$

This is clearly violated if  $(1 - F_R(x))x$  is decreasing in a relevant space, since  $c$  and  $c^{1/(1-\rho)}$  are both less than 1. Since in absence of persecution ( $\rho = 1$ ) the optimal bribe size is at least  $s^*$ , this is clearly not the case.

**Result 9** *For every  $\rho$  there is a big enough  $c$  such that it is better to extort  $s^*$  with a chance of persecution of  $1 - c$  than to extort  $c^{1/(1-\rho)}s^*$  and stay below anti-corruption radars.*

Result follows from continuity with respect to  $c$  around  $c = 1$ .

Finally, observe that the reasoning does not depend upon whether there is uncertainty about the  $K$  or not. This section shows that my “risk-averisty” representation of inspector’s behavior has reasonable microfoundations.